CONSTRUCTION STANDARD SPECIFICATION

SECTION 16441

ELECTRICAL LIGHTING AND APPLIANCE PANELBOARDS

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PART 1 - GENERAL

1.01 SUMMARY

A. Section includes lighting and appliance panelboards, and associated auxiliary equipment rated 600 volts or less, and 225 amperes or less.

1. Furnish labor, materials, services, equipment, supplies, and perform operations necessary to install electrical panelboards in accordance with this Section and Drawings.

2. Panelboards located in hazardous (classified) locations are not included in this Section.

3. Refer to Division 16, Section 16442 “Electrical Power Panelboards” for panelboards rated greater than 225 amperes, or where the interrupting capacity per panelboard schedule exceeds 14,000 amperes symmetrical for 480Y/120 volt panels or 22,000 amperes symmetrical for 208Y/120 volt panels.

1.02 REFERENCES

A. Related Sections: Refer to the following sections for related work.

1. Division 1, Section 01330 “Submittal Procedures”.

2. Division 9, Section 09900 “Painting”.

3. Division 16, Section 16001 "Electrical Work".

4. Division 16, Section 16442 "Electrical Power Panelboards".

B. Related Drawings: Refer to Standard Drawing E-0006STD, “Standard Symbols List and General Notes” for panelboard identification requirements.

C. National Electrical Manufacturers Association (NEMA)

AB 1 Molded Case Circuit Breakers

PB 1 Panelboards

PB 1.1 General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

250 Enclosures for Electrical Equipment (1000 Volts Maximum)

289 Application Guide for Ground Fault Circuit Interrupters

D. National Fire Protection Association (NFPA)

70 National Electrical Code

E. Underwriters Laboratories, Inc. (UL)

50 Cabinets and Boxes

67 Panelboards

486 A Wire Connectors and Soldering Lugs for Use With Copper Conductors

489 Circuit Breakers, Molded-Case, and Circuit-Breaker Enclosures

943 Ground Fault Circuit Interrupters

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1, Section 01330 “Submittal Procedures."

B. Product data for each type of panelboard, accessory item, and component specified.

C. Shop Drawings: For panelboards, include dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:

1. Enclosure type with details for types other than NEMA 250, Type 1.

2. Bus configuration and current ratings.

3. Short-circuit current rating of panelboard.

D. Maintenance Data: Include manufacturer’s written instructions for testing circuit breakers.

1.04 QUALITY ASSURANCE

A. Provide panelboards designed and assembled in accordance with the referenced standards.

B. Listing and Labeling: Provide new panelboards listed and labeled by Underwriter’s Laboratories, Inc., or other nationally recognized testing laboratory.

C. Single-source Responsibility: Provide panelboards products that are new, and from the same manufacturer. Panelboard components shall be from the same manufacturer, or listed as an assembly thereof.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Subject to compliance with requirements, provide products by the following:

Manufacturer	Panelboard Type	Voltage	Cabinet Width (inches)	*Branch Breaker Type
Cutler-Hammer /Westinghouse	PRL1a	240/208Y/120	28 (710 mm)	BAB-10KAIC QBHW-22KAIC
	**PRL2a	480Y/277	28	GHB-14KAIC
Square D	NQOD	240/208Y/120	***20 (508 mm)	QOB-10KAIC QOB-VH-22KAIC
	**NF	480Y/277	26 (660 mm)	EDB-18KAIC
Siemens	P1	240/208Y/120	24 (610 mm)	BL-10KAIC BLH-22KAIC
	**P1	480Y/277	24	BQD-14KAIC
GE	Series AQ	240/208Y/120	***20	THQB-10KAIC THHQB-22KAIC
	**Series AE	480Y/277	30	TEY-14KAIC

* Refer to Panel Schedule for AIC rating.

** Do not use on 480-volt delta system.

*** Deadfront cover is screwed to outer door.

2.02 GENERAL

A. Install UL-listed and labeled panelboards as required by NEC.

B. Three-phase, four-wire, 208Y/120 or 480Y/277 volt, deadfront, circuit breaker type distribution panelboard rated 225 A or less.

C. Panelboard with series rating will not be accepted.

D. Voltage and current rating, as indicated on Drawings or Panel Schedules.

E. Main circuit breaker or Main Lug Only (MLO) as indicated on Drawings or Panel Schedules.

F. Provide panelboards with size and number of single, double, or triple pole circuit breaker as indicated on Panel Schedules.

G. Arrange and number circuit breakers exactly as shown on Panel Schedules. Single-branch mounted or subfeed breakers are not acceptable.

H. Where the word "space" occurs in Panel Schedules, it is intended as space for future branch circuit breaker, and will include connection straps rated at minimum 100 A, holding brackets, and identifying numbering unit so that conversion to active circuit only requires actual installation of circuit breaker.

I. Panel Schedule Holders: C-Line Products self-adhesive clear heavy vinyl shop ticket holder, size 9" x 12" (Stock No. 70912) or 5" x 8" (Stock No. 70058).

2.03 CABINETS AND TRIM

A. General: Provide NEMA 250, Type 1 cabinets, unless otherwise indicated on Panel Schedules.

1. Comply with UL 50 requirements for specified cabinet type.

2. Provide NEMA 250, Type 3R or Type 4 for exterior-mounted panelboards, as indicated on Drawings or Panel Schedules.

3. Flush- or surface-mount cabinets, as indicated on Panel Schedules.

B. NEMA 250, Type 1 Cabinets Galvanized steel; zinc-coated galvannealed steel is not acceptable.

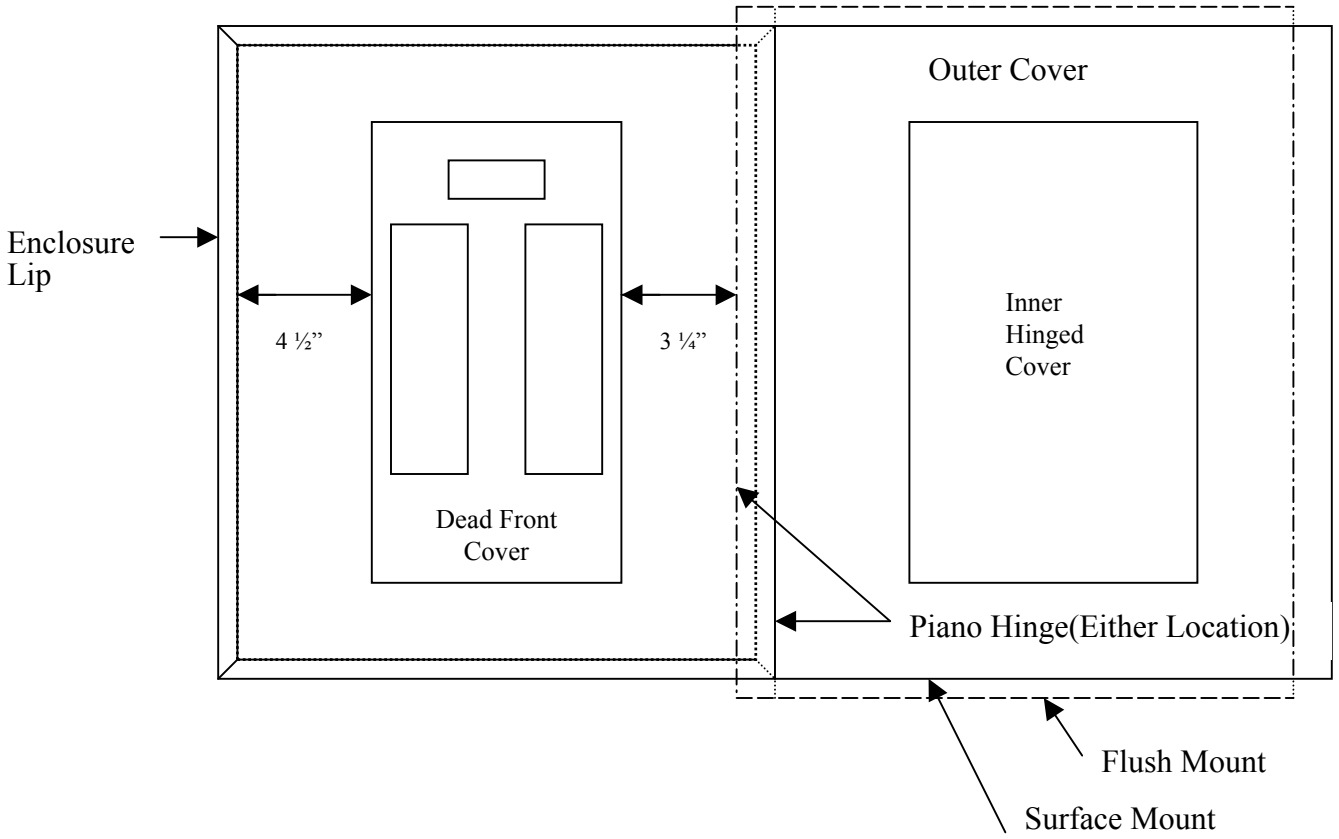
C. NEMA 250, Type 1 Trim Front: Provide one-piece, hinged "door-in-door", and one-piece, removable, inner deadfront cover plate. Secure deadfront cover plate by maximum of six removable screws.

1. Provide interior hinged door with latch to cover access to circuit breaker operating handles, but without access to energized parts.

2. Provide outer door with either a piano hinge along one vertical edge of trim, or outer door with piano hinge on one side of door.

a. Provide captive screws, screw driver operated latches, or screws and screw clips, if providing screws and screw clips provide 25% spare.

b. Outer door shall provide minimum clearance between deadfront cover and inside edge of hinged cover as shown on the following sketch.



Typical Panelboard Showing Required Gutter Space

3. Provide cabinet with extra gutter space as required to meet requirement listed in Item 2 above.

4. Prepare, prime, and paint front trim cover with light gray enamel electro-deposited over phosphatized steel, or baked-on polyester coating.

D. NEMA 250, Type 3R or Type 4 Cabinets

1. Type 3R: Provide outer door hinged at top or at side of cabinet, and latch at opposite side.

2. Type 4: Provide outer door hinged on side, and latch at other three sides.

3. Bolt interior cover on all four sides.

4. Weld and seal end walls, and provide door gaskets.

E. Provide micarta buttons, small window-frame, or permanent strip type identification labels on interior trim to identify circuit number. Do not use adhesive-backed fabric, or paper labels alone.

2.04 BUS

A. Phase Bus: Hard-drawn copper of 98 percent conductivity.

B. Neutral Bus: Hard-drawn copper of 98 percent conductivity.

1. Electrically isolated from enclosure.

2. Current rating not less than phase bus.

3. Screw terminal for each breaker position.

C. Grounding Bus: Hard-drawn copper of 98 percent conductivity.

1. Ground bus shall be factory-installed to enclosure by brazing, or bolting to unpainted structural framing members.

2. Screw terminal for each breaker position.

D. Provide subfeed lugs or through-feed lugs if required, or indicated on Drawings.

2.05 CIRCUIT BREAKERS

A. General: Provide circuit breakers as integral components of panelboard with indicated features, ratings, characteristics, and settings.

B. Mounting: Direct-bolted connection between source terminal of circuit breaker and phase bus. Bolt-on circuit breaker shall be replaceable without disturbing adjacent units.

C. Molded-Case Circuit Breakers: Comply with UL 489 and NEMA AB 1.

1. Characteristics: Frame size, trip rating, number of poles, and short-circuit interrupting capacity rating as indicated on Drawings or Panel Schedules.

a. Interrupting Capacity: As indicated on Drawings or Panel Schedules.

b. Voltage and frequency ratings shall be same as panelboard.

2. Tripping Device: Quick-make, quick-break toggle mechanism with inverse-time delay and instantaneous overcurrent trip protection for each pole.

a. Provide multi-pole molded-case circuit breakers to incorporate internal tripping of all poles.

b. Do not provide circuit breakers with “handle-ties”.

3. Adjustable Instantaneous Trip Devices: Where available, front-adjustable on units, and factory-adjusted to low-trip setting. Adjustments shall be accessible without removal of deadfront cover.

4. Where indicated, provide combination circuit breakers and ground fault circuit interrupters (GFCI) in accordance with UL 943, arranged for sensing and tripping for ground fault current in addition to overcurrent and short-circuit current. Provide features as follows:

   a. Match features and module size of panelboard breakers, and provide clear identification of ground fault trip function.

   b. When ground fault protection of personnel is indicated, provide trip setting of 4 to 6 mA. Provide GFCI circuit breaker listed and labeled as Class A, Type 1 device.

5. Terminal Lugs: Provide load side of circuit breaker with front-connected UL-listed lugs for copper cable at full frame rating. Provide terminals rated for minimum 75 degrees C.

6. Provide single-pole circuit breakers rated 20A or less, that are switching and HACR duty rated.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Install in accordance with NEMA PB 1.1, NFPA 70, and manufacturers' written installation instructions.

B. Install panelboard ground fault circuit interrupter devices in accordance with installation guidelines of NEMA 289.

C. Wiring in panel gutters shall be trained neatly in groups, bundled and wrapped with wire ties after completion of load-balancing. Form wiring to right angles at circuit breaker connections.

D. Grind smooth corners, and file or grind smooth edges of metal angles, channels, straps, and other similar items to be used to support electrical panelboards. Paint to match panelboards prior to installation, per requirements of Section 09900, “Painting”.

E. Panelboard Identification: Refer to Standard Drawing E-0006STD.

F. Conductor Identification: All conductors in panel shall be tagged, including neutral and ground conductors.

   1. Tags shall indicate circuit number.

   2. Install a Bradey slip on label on conductors sized less than # 6 AWG and install a Panduit #MP-350C tag and tie-wrap for conductors sized # 6 AWG or larger.

   3. Use a Panduit marking pen PX-O or a Sharpie permanent marker for labels.

G. Provide conduit terminations in enclosures in a manner to maintain integrity of enclosure. Example: Terminate at NEMA 250, Type 3R panelboard with rain-tight hubs, when entering panelboard from top.

3.02 MOUNTING

A. Mount panelboards plumb and rigid without distortion of box.

B. Arrange flush panels so that enclosure front surface is uniformly flush with wall, and exterior door covers wall to enclosure mating surfaces. Provide for future circuits as shown on Drawings.

1. If not shown on Drawings, stub minimum of four one-inch (25-mm) empty conduits from panel into accessible ceiling space or space designated to be ceiling space in future.

2. If not shown on Drawings, stub minimum of four one-inch (25-mm) empty conduits into raised floor space, or below slab other than slabs-on-grade.

C. Surface-mounted panelboards located on finished walls as shown on Drawings, shall be furred from floor to ceiling to provide conduit chase.

1. Provide 20-gage sheet metal furring panels, and install with sheet metal screws to permit removal.

2. Install spare conduit or other types of penetrations within chase area at floor and ceiling, as detailed on Drawings.

D. Mount panelboards so that distance from floor to center of top panel does not exceed 6’-6” (2 m), unless otherwise noted on Drawings.

E. Permanently mount self-adhesive heavy vinyl shop ticket holder, appropriately sized for door size, to inside of each panelboard door. Place copy of up-to-date Panel Schedules inside holder.

3.03 CONNECTIONS

After installation, but before panelboard is energized, tighten electrical connectors and terminals, including grounding connections, in accordance with manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.

3.04 GROUNDING AND BONDING

A. Run separate equipment grounding conductor with panelboard incoming feeder circuit and all branch circuits. Size equipment grounding conductors as shown on Drawings, and run in same raceway as associated ungrounded and neutral circuit conductors.

B. Bond neutral bus to enclosure grounding bus after any separately derived system, if neutral and ground are not bonded at transformer (refer to grounding one-line diagram when furnished).

3.05 FIELD QUALITY CONTROL

A. Verify neutral ground connections and phase connections.

B. Perform field tests and inspections, and prepare panelboard for satisfactory operation in accordance with manufacturer's recommendations and requirements of this Section.

C. Circuit Breaker Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system configuration and parameters.

1. Where discrepancies are found, provide Sandia Construction Observer (SCO) with recommended final breaker ratings and settings.

2. Use accepted ratings or settings as directed by SCO to make final system adjustments.

D. Visual and Mechanical Inspection: Include the following inspections and related work:

1. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and Panelboard Schedules.

2. Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer's instruction manual.

3. Check panelboard mounting, area clearances, and alignment and fit of components.

4. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values. Contractor shall place marking in torqued connections.

3.06 CLEANING

Upon completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish, or color as indicated on the Drawings.

END OF SECTION 16441